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III.—*Journey through the Himma-leh Mountains to the Sources of the River Jumna, and thence to the Confines of Chinese Tartary: performed in April—October, 1827, by Captain C. Johnson, late of the 11th Dragoons.* Analysed from his MS. Journal, and communicated, with remarks, by W. Ainsworth, Esq., F.R.G.S., and Foreign Correspondent of the Geographical Society of Paris. Read 24th Feb. 1834.

HAVING formed a party with two of the officers of his regiment, Captain Johnson left Cawnpore on the evening of the 1st of April, 1827, and after a journey, in palanquins, of about three hundred and fifty miles, arrived at Hurdwar during the period of the great fair held there in the early part of April. Hurdwar (Heri, Vishnu, and Dewar, a passage) is at the foot of the first range of hills met with on approaching the great central chains; and here the union of the Bageruttee and the Alacnunda, called the Ganga or *the river*, forces its way through the mountains from the valley of Deyral into the plains. The spot where the waters first issue from the mountains is peculiarly sacred, and the assembling of persons from the most remote parts of India, to perform those ablutions which their religion enjoins, led ultimately to the institution of a fair, or mercantile meeting.

The pagodas, with the ghauts for bathing, occupy the right bank of the river, under the town, through which lies the only path into the Deyrah Dhoon, or valley. The mountains on each of the pass are of no great height, and rise on the one side with a perpendicular face of bare rock, and on the other with a gentle slope, wooded to the summit. The Fakeers, who make Hurdwar their abiding place, have generally caves hollowed out in the rock above the pass, and accessible only by means of ladders: some few reside in the temples. Captain Johnson considers Raper's estimate of the visitors at Hurdwar, one year with the other, at two millions of souls, as being rather below than above the true average.

Our traveller took the opportunity of a short stay at Hurdwar, to visit Kunkul, a neighbouring collection of sacred buildings of the Hindoos. There were pagodas and deotas of all sizes and shapes, some of the handsomest specimens of Hindoo architecture which he had seen, only much defaced by the uncouth figures of their mythology painted on the outside in glaring colours, and with an utter disregard of proportion and ignorance of perspective. The total want of observation of a native artist cannot be more strongly exemplified than in the representation of the "Tenth Avatar," where Vishnu, like our Death in the Revelation, is expected to appear mounted on a white horse; the horse is invariably represented at a trot, either with both the off or both the near feet

SKETCH
OF PART OF THE
HIMMA-LEH MOUNTAINS,
to illustrate the Paper by
CAPT^N JOHNSON.



raised at the same time, which peculiarity of motion belongs to the camel but not to the horse.

The valley of Deyrah, which our traveller entered by the pass of Hurdwar, varies from twelve to fifteen miles in breadth, and may be about seventy miles in length, extending in a nearly east and west direction to the foot of the second range of hills. The entrance to the valley was peculiarly beautiful, with a most luxuriant and almost virgin vegetation; in the tree-jungle, the creepers attain a very great size, spreading from tree to tree, matting the whole together, and rendering it impenetrable even to an elephant. The Dhoon, from this reason, is unhealthy, except in the neighbourhood of Deyrah, where the jungle has been burned for several miles around. The valley is otherwise cool, and watered by numerous rivulets, abounding in fish resembling trout; and the jungle abounds in all kinds of *game* from the tiger to the quail. The character of the trees, and the scenery generally, resembled very much that of our own latitudes, and this illusion was only destroyed by occasional glimpses of the snowy range, and by the appearance of black partridges and jungle cocks. Greenswards, from the growth of graminæ, begin in these regions to occupy the surface soil, more particularly beneath the shade of the banyan-trees.

As they advanced up the valley they were obliged to cross the dry and stony beds of rivulets and rivers; the wooded undulating ground and open lawns had disappeared, and the country was flat, rather swampy, or covered with withered graminæ.

The distant snowy peaks of the Himma-leh, seen from these spots, had an extraordinary appearance, the acclivities of the mountains being concealed by the clouds, and the loftiest peaks starting in an almost irre recognizable manner from the blue sky above.

The tree jungle of the Deyrah Dhoon consists mostly of teak, leesoo, and some pines; in the vicinity of Deyrah were topes or groves of mangoes; in the court of the Seik Temple, jack-trees; and in the hills beyond Deyrah, cultivated land, abounding in corn.

The small town of Deyrah is about four miles from the second range of hills, and is formed by the cantonments of the Goorkha regiment, raised after the Nepaul war, and the native bazaar attached to it. Within a few miles of Deyrah is the Fort of Katuga, not in itself a place of strength, but in a nearly inaccessible situation, and during the Goorkha warfare, it was desperately defended by that tribe.

At Deyrah the party hired coolies, and started on the 21st, following the windings of a small mountain stream till they came to a low fall, above which the stream expanded into a small lake;

they then crossed over a wooded hill to the right, through thick brushwood, abounding in pheasants and other game-birds, and proceeded to the village of Nagul, situate on a steep bank over the river Saone; the valley of which forms the entrance into the second range of mountains. From hence the party followed the bed of the river, which is strewn with huge rocks for about a mile to the dripping rock of Sansadarrah, opposite to which there is a small shed for travellers.

The dripping rock of Sansadarrah rises to a considerable height over a small basin of water, which is only a few yards from the river. The rock overhangs this basin like the roof of an open piazza, extending for about fifty yards in length. Above it there is a small stream, which flows from the mountain side to the edge of the precipice, where, instead of forming a cascade, it is absorbed by the marshy nature of the soil, is filtered through the rock, and falls into the basin in a perpetual shower. The rock is covered with beautiful stalactites, which are more remarkable in a cave to the right (in facing the rock), where the roof is actually studded with them, and where stalagmitic incrustations abound on the floor, which, meeting the stalactites, look like pillars supporting an edifice. In the bottom of the cave the water is about two feet deep. A curious deception occurs when the sun does not shine on the sparkling drops,—they become quite invisible, and the water is so entirely lost sight of, that our traveller could not convince himself that it had not ceased falling till he crossed the stream to view it more closely.

Around Sansadarrah the hills rise almost perpendicularly on every side to the height of five thousand feet, and are clothed to the very top with the most beautiful wood. As there is always a breeze above, the rustling of the trees mingled with the sound of the falling waters and the murmuring of the Saone, assisted by the great heat, has a lulling effect, and gives a peculiar charm to this spot. Our traveller's remarks on the rustling of the leaves remind us of similar impressions experienced by De Humboldt in the forests of the upper Orinoco, where the absence of that sound gave even a greater intensity to the disagreeable sensations caused by heat.

At this point of their journey the travellers were obliged to abandon the outer fly or cover of the large tent, which could not be carried along these almost pathless tracts. In the vicinity of Sansadarrah there is a spring, impregnated with sulphuretted hydrogen, and depositing sulphur in a thick coat on the edge and bottom. The waters were clear and tasteless.

The road, on leaving Sansadarrah, wound for the first mile along the hill, at a great height above the river. As they were moving along one of the party shot a rocket-bird, the first they had

seen. After passing an open spot, where the Kaldee torrent, or Gadh, joins the Saone, the ravine contracts, and the road lies in the bed of the torrent, which is filled with large rocks, rendering the progress very difficult. They here met with a party who were twenty days' march from Gangoutree, three in deep snow. They carried one of their number in a basket, his leg having been shattered by a falling stone. In the continuation of their journey beyond Rhudwarah, the path ascended in a zigzag manner up the face of a nearly perpendicular precipice, till at the height of about three thousand feet above the ravine, the crest of the ridge is attained, and the road again descends into a deep and gloomy valley called Muggra.

This is the second range of hills traversed in approaching the Himma-leh; and from the crest on the one side was seen the rich valley of Deyrah, with the plains of Sehampore in the distance; and on the other, hills clothed with pines; and beyond, the gigantic peaks of the snowy range towering above everything.

This is the first appearance of pine-trees, which commence on the upper parts of the hills; lower down were abundance of vegetables, wild fruits, and shrubs. They noticed cherries, pears, raspberries, and strawberries. Nothing could exceed the number, beauty, and variety of flowering shrubs. Whole sides of hills were sometimes covered with yellow and white jessamine, gum cistus, and the scarlet rhododendron, which grows to the size of a forest tree. Pheasants and chuccores, or red-legged partridges, were numerous.

The road rising from the Muggra winds over a shoulder of the hill, past the village of Belee, and then descends for about a mile. After which the party encamped on a small terrace at the entrance of a beautiful valley, cultivated in the lower parts. Below was the village of Phadee, round which the hills expand into a fine amphitheatre. Among the forest trees were hollies and oaks, the latter inferior in size and foliage to the English species. On the banks of the Uglawar, the mountains were found cultivated for about one-third of their height; the face of the hill being cut into ledges (cates or keats) like steps or stairs, each ledge being about five or six feet above the next to it. The water being retained successively in each cate by an enbankment, to the depth of two or three inches, and let off into the next by its removal.

The inhabitants of this valley appear well off, with plenty of buffaloes and sheep; their dress is entirely of blanket stuff, and consists of trowsers and a kind of tunic, with a loose blanket thrown over, and fastened on the breast with a large steel or brass pin; the head-dress is merely a long blanket cap, rolled into the form of a turban, and fitting the head at the top like a skull-cap.

Our party stopped at a halting-place called, after a temple,

Bewaunee, the nearest village to which is Thaun, from whence they obtained supplies. White and red raspberries grew in the vicinity. The Jumlee torrent is here crossed on a sango or pine bridge. As they advanced along a road which sometimes followed the bed of the stream, and at others ran along the face of the cliff, the country became wilder, and the hills entirely bare towards the top, though cultivated below. Huge isolated deodars (*Pinus deodar*), which resemble the true cedar, and are confined to great elevations, were observed springing from the bare rock, where no other tree could find root. The kaukur or barking deer, and the ghurl or wild goat, are found on the hills near this. After passing the prosperous village of Bâlâ, having seven or eight good slated houses, they came to Morarra, a miserable village on a bleak hill, but with some cultivation in the valley. Here Captain Johnson was taken ill, and on the third day was carried by coolies on poles, in the continuation of his journey. The road lay up-hill to the Corassoo Gorge, and then descended for four and a half miles along the face of the precipice, past the village of Laloorie to the Nagun Gadh, a pretty copious stream at the foot of the Janda'gan hill. The party crossed it, and encamped at the opposite side. The country around was well cultivated. At the top of the gorge the forest trees were oak, pine, and rhododendrons. Here our traveller was again obliged to rest on account of ill health.

The 1st of May, again travelled in the chair; the road one mile of ascent, and two miles a level and gentle slope, along the face of the mountain, where the Nagun joins the Bagiruttee. The latter river here runs along a fine cultivated valley about half a mile wide. The mountains rise almost perpendicularly from it; and on the western side are three or four comfortable villages. After a pleasant route of five miles they arrived at Barettee. Passing the village of Dhurassoo, our party crossed the Gudoul; and in a cave, a little above the river, found the last survivor of a convent of Jogee nuns—a clean, happy-looking old woman, about eighty years of age, and who gave them odoriferous roses. Two miles of ascent brought them to the village of Pottorrah, where they encamped, at an elevation of about four thousand feet immediately above the Bagiruttee, but could not hear its waters, which in the sunshine looked like a vein of bloodstone.

After about six miles march, alternately ascending and descending, and passing through groves of pines, they came to the village of Dhoondra, small and excessively dirty. The houses, as usual, consisted of three stories; in the lower the cattle are kept, the second is shut up and is a kind of granary, and in the upper the family reside. Below the village the river is confined by two jutting rocks, over which is a sango.

At the village of Mattee, their next stage, the thermometer

stood at 92° in the tent. Crossed the Barettee on a sango, the planks quite decayed, and encamped at the town of Barahat. This day they found an ant's nest, formed of leaves agglutinated by a kind of gummy substance, on the top of a tree. Captain Johnson visited at this place a temple which was destroyed by an earthquake in 1803. There was here a trident, formed of brass, about sixteen feet high; the base of which was a globe of the same metal about thirty inches in diameter. On the octagonal shaft is an inscription, of which Raper, who had a man with him who read Nagni Sanscrit and Persian, could obtain no satisfactory information. The rajah of Nepaul sent a deputation of learned men, some years ago, to examine it, but they also failed in recognising the characters. The inhabitants have a tradition, that the country was once inhabited by, or tributary to, the Chinese Tatar dynasty, and some who have seen the inscription have remarked a similarity between the characters and those of the Chinese.

On the 6th of May our traveller left the Bagiruttee, and turned off to the left to ascend the ridge that separates that river from the Jumna. The road lay along the Barettee Gadh, having a steep ascent to the village of Haila, and then continuing along a glen, where the matting of trees and creepers almost precluded light. At the head of the glen was the village of Kowa, in the district of Salma, surrounded by a wood of deodars, some of which were of an enormous size. The party afterwards passed through a forest of scarlet rhododendrons to the village of Oprekhôt, and crossing a range of hills, descended into a valley, which they left by ascending a steep hill to the pass of Jakeeni Ghati (about nine thousand feet), from whence they had a fine view of the Roodroo Himma-leh—the mountains above Gungootri. They then descended again to the Shialba rivulet, a tributary to the Jumna. The road hence continued down the glen to the village of Kanoora, where they first saw the Jumna; it lay at the bottom of a ravine, fifteen hundred feet below them; and on the opposite side, and at a similar elevation, were the villages of Patra and Thaur. The houses in Kanoora consisted of five or six stories, the uppermost and the roof projecting about six feet all round.

From this place our party began their ascent up the Jumna to Catnaur, a village situated in a small cultivated recess of the mountain, about five hundred feet above the river. The water of the Jumna was of a deep and almost inky blue. The snow was lying in patches on the hills around. Thermometer at sunrise 48°, at noon 72°. In passing through a pine wood they came to a forest of large deodars which had been on fire, and of which nothing but the black and charred trunks remained. The fire had been stopped by the river, on the opposite side of which the trees wore their usual green livery. The road our travellers came from

Barahat is not the shortest, as there is another that descends into the valley of the Jumna, two marches higher up, but which was at this time impassable on account of the depth of the snow.

From Catnaur they proceeded a short distance along the course of the river, which they then crossed on a sango, twenty paces in length and two feet broad. The precipices rose above the river to a height of fifteen hundred to two thousand feet; the bed of which was two to three hundred paces across. The rocks were mostly composed of granite, but some of the masses that had fallen down appeared to be of white marble. They passed the village of Djenee, which lies on a precipitous cliff, surrounded on three sides by the torrent. There was formerly a fort at this place, but it was destroyed by the earthquake in 1803. From this spot they had their first distinct view of the Bunderpouch. Having crossed another perilous sango, they approached the village of Consala, through a thick wood of apricot and walnut trees.

Beyond Consala they crossed the Sumna Gadh by a sango, and climbed up the steep cliffs to Kana, a comfortable and well-built village. The road hence wound along, about eight hundred feet above the river, through groves of mulberry, apricot, and walnut trees. A rugged descent brought the travellers to the Rheam Gadh, the water of which forms a cascade of about fifty feet in height, and has hollowed out a course for itself in the face of the cliff something like a chimney open in front.

The road ascended to the village of Bahree, and then again descended to the bed of the Bhurai Gunga, which is nearly as wide as the Jumna, and which they crossed by a sango, continuing their route to the bed of the latter river, which was also crossed on a bridge of similar construction, and which appear to be so much the object of the travellers' dread, to the village of Bonassoo. From the latter place they proceeded along the banks of the river, crossing and recrossing several times; the last time was at the place where it receives the Jinri or Oonta Gunga, a rapid stream which has its sources in the snow of the Bheen Ke Dhar, a versant of the Bunderpouch. The ascent to the village of Cursolu (about nine thousand feet above the sea) was very steep and laborious. Cursolu is a most isolated spot, having no communication with any habitable place except by the almost impracticable path by which our travellers had come. It had nevertheless some appearance of prosperity, consisting of about twenty-five houses, with three or four temples, built like the former of stone and pine, with excellent roofs of carved deodars; and probably two hundred and fifty acres of arable land. The inhabitants manufacture their own clothes (blankets), and seem to want little.

The Jumnotree Glen ran N.N.E. from this, and had a gloomy and repulsive appearance. The peaks of the mountain itself

could not be seen in such close proximity, being hid by the gigantic deodars which threw their vast shadows around the base of the mountain group, and which attained a size, according to our traveller, "tremendous to look at." The party experienced at this place one of those awful thunder-storms which are peculiar to Alpine regions.

There is a route from Cursolu to Looké on the Bageruttee, two days' march from Gungootri, which was impracticable at this season. The path lies over Bheem Ke Dhar, two days in snow, and four without meeting a habitation. Fraser crossed it in July, deep in snow; and estimated the height of the ridge at fifteen thousand seven hundred feet; and at that height, says that the N.W. peak of the Bunderpouch was between seven and eight thousand feet above him.

No one had been for the last two or three years to Jumnotree, so our party had to send people on to make bridges and ladders. On the morning of the 12th of May, they proceeded up the glen to Jumnotree; the cultivated land extended for a mile beyond the village. They then descended into the bed of the river, making their way through masses of rock and loose stones, crossing and recrossing the stream several times, sometimes on sangos, but as frequently wading. The steep ascent of Bheiro Ghati, which they next came to, was made through a jungle of dwarf bamboo and barberries, with interspersed pine trees. They here reached a temple, consisting of three upright stones, with another placed across the top; containing offerings of small iron tridents to the Byram Jee, the goddess of the stream. They descended a steep acclivity of loose stones and clay on the other side, and reached the bed of the river, where it was joined by a small stream which fell from a rock fifty feet high, and under which they were obliged to pass.

Our party proceeded up the river, sometimes climbing steep and smooth rocks, by means of ladders formed by notches cut in pine trees, till they came to a point where the glen is about forty yards broad, and the snow fills up the bottom to the depth of twenty or thirty feet above the stream, which forces its way underneath through "most extraordinary-looking caverns." Cliffs of grey granite rose at the sides, almost perpendicularly, to the height of twelve or fourteen thousand feet; and the huge pines, rooted in the rocky clefts, and overhanging the glen, added in no small degree to the sombre character of the scene.

They pursued their way for about a mile and a half up this fearful ravine, sometimes on the snow, and at times in the bed of the river; for wherever the cliffs were so far separated as to allow the sun to penetrate to the bottom the snow had disappeared. It was in walking in the bed of the river, and on coming to a

narrower part where the snow was unmelted, that they obtained a full view of these "extraordinary caverns." Sometimes the snow had melted away from the heat of the rocks to the height of five or six feet above the stream; while the mass above, being still eighteen or nineteen feet thick, spread in an arch almost the whole way across the valley, or was supported here and there by some of the rocks that rose higher than the others, and served as pillars to this singular icy roof.

On one of the beds of snow our party found the remains of several musk deer and custoorees, which, though very much decayed, still retained a strong odour of musk.

They continued their way up a wall of rock, over one part of which the river precipitated itself with great violence, till they came to the hot springs of Jumnotree. They have their source in a ledge of rock, ten or twelve feet above the bed of the river, and fall down into the stream, covering the rock with a sediment of variable colour, but chiefly yellow, and soft and spongy to the touch. Above the ledge, the hot water forces its way through a cleft in a smoking jet of five or six feet in height, which has melted the snow around to the distance of twenty or thirty yards. The Hindoos bathe in a small basin, where the waters of the river are mingled with those of the hot springs and remain sensibly warm, after which they are marked on the forehead with the yellow sediment of the hot springs. This place was generally considered as the source of the river Jumna, and was the farthest point reached by Hodgson or Frazer; and it was with some difficulty that the pundit was prevailed upon to go any farther, his presence being necessary to secure the attendance of the guides. The party, however, advanced for half a mile over a snow-bed which completely covered the stream to the thickness of thirty or forty feet; this ravine becoming still narrower, till at last they came to an opening where the rocks formed a small amphitheatre, and allowed the snow-bed to expand to about three acres. Exactly opposite, as they entered this circus, was a bare cliff about forty feet high, over which fell a small streamlet, apparently given birth to by the melting of the snow above. It was received in a small basin of granite, and overflowing, forced its way under the snow on which they were standing in the direction of the hot springs. On the left a small ravine was visible for a few yards, but was completely blocked up with snow, and without the slightest appearance of water; above, they had a full view of the mountain, rising nearly four thousand feet, and also coated with frozen snow. This then was the highest point of the Jumna yet attained, and elevated, Captain Johnson supposes, eleven thousand two hundred feet above the level of the sea, the hot springs being ten thousand eight hundred and forty. Pine trees were flourishing

in forests in the snow fifteen hundred to two thousand feet above them.

The vegetation in coming up the ravine was first holly, growing to the size of a forest tree, oaks and hazel, with an underwood of yellow jasmine, rose, and the rhododendron in the clefts of the rocks. Then stunted birch, mixed with barberries, till at last even the dwarf bamboo failed, and nothing was to be seen but the huge deodar springing from the snow, and extending in forests as far as the eye could reach.

The distance from Jumnotree to Cursoli is not probably more than five miles in a direct line, and our party returned without any accident, save the rolling down of the pundit, and two of the guides, for a considerable distance in the snow, and having only suffered from the heat of the sun, and the fatigue of so perilous an undertaking.

Captain Johnson and his companions started without delay to the southward, being anxious to reach the Broang Ghati, the lowest of the passes into Kunawur, before the commencement of the periodical rains. The road by which they had to proceed thither had never been travelled by an European. On their return they visited, at Bonassa, a spot where the river makes a fall of about eighty feet, the rock being a yellow stone like marble. There was a hot spring in the vicinity, the waters of which deposit a yellow sediment, and were found to boil rice.

From Consala they retraced their steps to Catnaur, from whence they proceeded through a forest of pines high above the river, and descended through a cultivated land and alternating jungle to the bed of the Shialba rivulet. They afterwards crossed the Jumna upon a sango, consisting of a single unsquared pine, traversing from the side they were on to a rock in the centre of the stream, and completed by a similar communication from the centre to the other side. They afterwards continued along the right bank, and made a steep ascent of five hundred feet to the village of Thaun. From hence they proceeded southward to the Nugwan Gadh, described as presenting the usual rocky scenery, passed the village of the same name, which was large and populous, and encamped at that of Patra.

Having ascertained here, that there was a shorter road to the junction of the Pabur and Tonse through the Rama Serai—the happy valley—our traveller turned westward at once, and proceeded over the shoulder of the hill to Dookeat, and then turned in a west-north-west direction up the Bunal Gadh. They proceeded about five miles up this glen, which was studded with villages, and cultivated in every square foot of ground. Being the first Europeans who had gone this way, they were the object of much curiosity among the natives.

They crossed the Bunal Gadh, at the village of Goodoori, and continued their road up to the Kanda Gadh, a beautiful glen, abounding in black partridge. After three miles journeying, they arrived at the village of Kanda, on the ascent of the Durstall Ghati, and in the midst of a forest of various foliage. At the top of the Ghati, they got their first view of the Rama Serai, a fertile valley about a mile and a half, or two miles broad, and which stretches in a north-easterly direction for eleven or twelve miles up to the old fort of Sircote, which is situated on the extreme point of the Kedar Kanta, a lofty shoulder thrown out by the snowy range between the Bunderporah and the source of the Tonse. The Rama Serai was formerly a royal forest, under the native dominion, and preserved as a chase. It is now much neglected and thinly inhabited, the luxuriance of vegetation rendering it extremely unhealthy. The valley is said to abound in leopards, bears, deer, and wild hogs. Tigers have been said to be met with in the same district, but Captain Johnson remarks, that he saw no trace of them, and the inhabitants, who had plenty of bear and leopard skins among them, never alluded to any larger animal of the latter kind.

Four miles beyond the entrance they reached the village of Kundal, near Ghoondeat, which is the largest in the valley. Here they purchased sheep, to drive with them into the hills. Beyond Ghoondeat they ascended a steep hill to the Jermala Ghati on the west side of the valley; they then descended to the north-west, through a forest of pines, leaving the fort of Sircote to their right, passed the end of Kedar Kanta, and arrived, after a rapid descent, at the Gooroo Gadh, a tributary to the Tonse. They were obliged to ford this stream twice before reaching the village of Kursar. The inhabitants here had never seen Europeans.

At the foot of the Gooroo Gadh, they had their first view of the Tonse, which was then a deep and strong flowing river, twice the size of the Jumna, the waters discoloured by the melting of the snow. Having crossed the river in a sango, they encamped, up its bed, at a place called Ghoon Khatra, but where there is no village. The scenery presented the usual peculiarities of rugged rocks, and nearly vertical cliffs, with pines springing from the most barren spots, forests of the same trees, with an undergrowth of strong gramina, and occasional patches of greensward.

Our party left the Tonse by the Marmoor Gadh, a small stream in a dark and gloomy glen, overgrown with grass and weeds, and at the source of the stream they made a very steep ascent to the right, which brought them to Petri, a little village, perched almost upon the top of a stony peak. Apricot trees grow around the village, and black partridges and chuccores were calling in all directions.

From Petri they continued across the hill to Sorass, from whence another short ascent, and a deep fall through beautiful woods of silver fir, brought them to the ascent of the Balchoo Kanta. The difficulty of this ascent was much increased by the immense number of fallen deodars, whose trunks were mostly from sixteen to twenty feet in circumference, and which constantly impeded their progress.

From the Ghati or gorge of the pass, they descended through fine forests to the Chighin Gadh, a tributary of the Pabur; halted at Gokal Khoti, a village a few hundred feet above its bed, afterwards crossing the stream which they followed to its junction with the Cuneat Gadh, a large and rapid torrent, passing the village of Dooghull; they crossed the latter stream on a sango, and had a long and laborious ascent to the village of Kirwan, which is very poor and mean, being about three thousand feet above the Pabur, and built among immense loose masses of rock, some of which appeared as large as the village itself. Apricot trees grew around, and lizards were seen in great abundance. A short march from hence, on the side of the hill, brought them to Azalt, prettily situated in view of the Pabur, and with much cultivation around.

From Azalt they made a rapid descent to the Coomoan Gadh, and then ascending the opposite valley, crossed the brow of the hill into the valley of the Pabur. The ascent from this continued by Mundul, a large and populous village, to Kontan, two thousand seven hundred feet above the river, and seven thousand eight hundred and ninety-eight feet above the level of the sea. The turf on which they encamped at this elevation, Captain Johnson compares to that of our own peat bogs. Our traveller was obliged to halt here for a few days, being again an invalid, and the whole party were severely incommoded by a small fly, about the size of the sand-fly, and very numerous.

The Pabur is a wider stream and not so much of a torrent as the other rivers, nor do the mountains rise so perpendicularly from its bed, but slope gently for the first three thousand feet. The whole is richly cultivated, and dotted with villages, each shaded by its own grove of apricots and walnut trees, while beyond the line of cultivation, the pine-woods rise to the top of the hills in one thick mass, only broken by an occasional greensward, where the villagers send the cattle in the day-time.

On leaving Mundul, our party proceeded by Racengurh (a station for a few Gorkhas) to the village of Hant, being a descent altogether of about three thousand feet, in a distance of about four miles. The road up the Pabur, from this to Roroo, a thriving village, was the best they had yet met with in the hills. From hence to Mundla the route was rocky, barren, and uninteresting;

and from this village they made a short excursion to Chegong, to obtain provisions. After crossing the Andreyti, the western branch of the Pabur, which flows from the foot of the Shatool pass, they ascended to Pekal, and from thence to Tekree, where the scenery became more beautiful. Jaen was the farthest village up the glen, and after a long ascent they reached the top of the ridge. The river at the foot of the mountains made a sudden turn, so that the road, taking a northerly direction, brought the vast snowy range before them in all its magnificence.

A most splendid fall of water was observed at the head of this glen; several streamlets unite a few hundred feet below the line of snow, and falling over a solid wall of rock, make only two shoots down to the bed of the Pabur, a distance of about fifteen hundred feet. The first is the longest, and for some distance the waters keep in a tolerably compact mass, but which soon separates into white foam; lower down, even that disappears, and before it reaches the ledge could not be seen at a distance of half a mile. It reappears at a great distance below, reuniting in a short channel, from whence it makes another shoot to the Pabur.

On the road to Leeti they came to the region of alternating patches of grass and snow, and the "last trees:" the trees so called by courtesy are a few stunted boge patras, a kind of birch, that had not yet put forth a leaf. Wherever the snow had lately melted, the ground was covered with polyanthus. The river is here covered with a bed of snow to a very great depth. Captain Johnson remarks, that what he calls a snow-bed corresponds with what in the Alps is called a glacier—the snow-bed of the Pabur being larger, but very similar in appearance to the glacier of the source of the Rhone.

They approached the Brooang Pass through the snow, only interrupted by the Pabur, which burst from the snow-bed at an elevation of twelve thousand nine hundred and fourteen feet, and fell over a piece of bare rock for about fifty feet. It was again immediately lost in the snow. Later in the season, the Pabur is said to flow from a clear lake about half a mile wide, which was now frozen over and covered with snow. After three hours laborious exertion, they reached the top of the pass (fifteen thousand three hundred feet). Our travellers had here a most magnificent view. On each side, to the north and south, the snow spread as far as the eye could reach; and east and west rose the peaks of the giant Himma-leh, to the height of four or five, or as much as seven thousand feet above them. Those which were least precipitous, clad to the summits in their white shrouds; others, as Kuldung (twenty-one thousand one hundred and three feet), rising in naked bareness, their cliffs too precipitous to afford a resting-place for the snow, and presenting nothing to the eye but vast pyramids

of bare granite, round which the clouds were fast gathering in sombre array.

Amid the thunderstorm they were obliged to hurry their way, running or skipping down the snow, till, after an hour's toil, in which they had gone about six miles, they reached the first trees on the north side, and took refuge under a hanging rock. Some of the Jaen people alone arrived that evening, bringing with them a small tent and some provisions. Some of the coolies came in, in a state of stupor, towards night, and the lighting of the fire brought in the remaining stragglers. Dr. Gerard was overtaken by one of these storms in the Goonass Pass, some miles east of this, when he lost two or three of his people, who died of cold, and he himself escaped only by indomitable exertion, having the flesh frozen off his toes; and with the loss of all his mathematical instruments, some of which were found the next year.

In their descent for Brooang, they passed forests similar to what occurred on the south side; and they measured a deodar, which was thirty-three in circumference, and from which the branches did not spring for a height of between sixty and seventy feet. Brooang is a pretty large village, situate at the junction of the Bulchutter and Buspa; the last, a large river, takes its rise four marches E.S.E. on the north of the Himma-leh, in Bhurassoo, and falls into the Sutluj, ten or twelve miles below Pooari.

Our travellers were now in Kurawur, according to the natives; the people from the other side call the country the Būdh Mooluk, —evidently the origin of Budhtar, and consequently the confines of Thibet. This day they saw the first *yak* which they had met with. The road along the river-side was dangerous and difficult, every trace of a path being at times obliterated. Near the junction of the Buspa with the Sutluj, they crossed the former on a sango. The Sutluj was confined between cliffs of vast height, and nearly vertical: it was about sixty yards wide. The waters were almost whitened by the quantity of sandy detritus which they bore down with them.

Our party followed a dangerous path on the face of the precipice to Kallah, a small village in the recess of the bank, surrounded by groves of apricots and vines. Out of seventy followers, all but twenty absconded from our travellers at this point, from dread of further dangers, and prejudices against visiting new countries.

They passed the village of Barung on a high rock under the Harung Pass, and, continuing along a bad path on sandstone, came to the beautiful little village of Pooari, situate beneath the wild Kuldung—embedded in a growth of apricot, peach, vine, and walnut trees; and still more strikingly luxuriant from the force of contrast.

The Sutluj is here about eighty yards wide, deep, and unin-

interrupted by rock, but flowing strongly, and dotted with whirlpools and backwaters. On the hills opposite, for a fourth of the way up, vine-trees clothe the rock, carefully trained on trellis-work; for a short way above, were the plantations of corn; higher, and covering half of the mountain, were the dark pine forests, and these were crowned by a diadem of snow. Below were the villages of Koongy and Telingee, built, as most villages were, on the points of cliffs projecting over the river, and shadowed by their deep groves of walnut and apricot trees. The inhabitants, like many mountaineer tribes, are extremely dirty in their habits.

From Pooari our party crossed the river by a rope-bridge, or Jhoola, to Telinga. In travelling thence to the large and populous village of Punjee, they left the pine forests to enter into tracts covered with a kind of wild camomile; and, after crossing a mountain torrent on a sango, reached the village, where they halted for two days.

Their road continued to the north-east, high above the river, and from whence they had some fine views of the snow range;—Rulding being most conspicuous. Captain Johnson thought that a peak of the same group, though nothing like so rugged in aspect, was in reality higher. It lay between the Sutluj and the Buspa; and over one of its shoulders is the Harung Pass. The rocks were full of eyries, and the eagles came down in parties of three or four to look at the strangers.

After the ascent to the Laptök pass, they descended to the bed of the Leesa, which was bridged over with snow, formed by an avalanche that came from the top of Oorung Teefa, and had torn a passage for itself through the pine forests of some hundred yards wide. There is a well-built wooden hamlet, bearing the same name as the stream, on its banks.

In the next day's journey, lying due north, they met with traders in salt, driving south. Sheep and goats are the only beasts of burthen in the mountains, and they carry salt or iron in saddle-bags, in return for corn. They are attended by large and fierce dogs, with long silky black hair. The yak had now become common enough; and they saw on the road large black-faced apes, about three feet and a half high. Our party arrived, through beautiful pasture ground clumped with pine-trees, at the village of Labrung, about two thousand five hundred feet above the Sutluj. On the opposite side of a ravine was the city of Kanum, a very large place, situate on a fine table-land, surrounded by rich cultivation. The houses were flat-roofed and clustered together; some of them seven or eight stories high, and looking like watch-towers. The town is eight thousand nine hundred and ninety-eight feet above the level of the sea; and the temperature in the shade delightful. There is in this city a Lama temple, and an

excellent library, said to contain a copy of every work to be found in the great library at Teshoo Loombo. Here they met with Tchoma da Coxas, an Hungarian traveller, who was there for the purpose of ascertaining the origin of the Huns. He came through Persia and the Punjaub; and some years before this presented himself on our frontier, and requested either to be forwarded to Ava or to be allowed to reside some years in Thibet. He had been in Luddak, and had acquired a knowledge of the language, but having become an object of suspicion, he had come south, and buried himself in the library at Kanum. He said that he had made some curious discoveries, and among others, that he had found translations of some of the classics—among the rest a very accurate version of Virgil. He was not very communicative, and lived the life of a hermit, upon an allowance granted him by the Company.

Our travellers left Labrung on the 23d of June, and began the ascent of the Kurung Ghati, and encamped that night at an elevation of about thirteen thousand feet. They, this day, to their great disappointment, received from the officer commanding at Soobathou, Lord Amherst's order, prohibiting, in the most positive manner, all attempts to proceed beyond the boundary of Hung-rung, for fear of exciting the suspicions of the Chinese. The next morning they reached the top of the pass (fourteen thousand five hundred feet). The snow lay deep on the north side, but did not extend far down. In their descent they visited Soongnam, a large and populous village, situate in a small cultivated valley, but at this time very hot: thermometer rising to 95° at noon. This place is under the Lama theocracy; and they do not burn, but bury their dead, and heap together long piles of stone, with the slate inscribed with the 'words of power,' as tributes to the deceased. The tumuli are arranged with a road on each side, to allow travellers to comply with the invariable rule of leaving them on the right hand.

The Durhony and Boukeo rivers unite at this point to form the Ruskolang, a tributary to the Sutluj, which river it joins at the village of Sheapoo, a Wuzzier's residence.

They ascended for about two thousand feet from the bed of the Boukeo, over a desolate country, the flowering plants of which were camomile, mint, and a few other aromatic plants, and the shrubs juniper, sweet-briar, and a kind of wormwood; and then proceeded by a winding path to the top of the ghaut (fourteen thousand eight hundred feet). Scenery as usual; the rock slaty, and mostly covered with snow, and little or no vegetation. A rapid descent of three thousand four hundred feet brought them to the village of Llango, the inhabitants of which had flat Tatar noses, and were clothed in Tatar black and red blankets; and the lan-

guage differed from that hitherto used. Indeed, it had retained some mixture of Hindoostanee only as far as Soongnam.

Our party approached the village of Tooling, through a slaty formation, where the rivulet, whose banks they had been following, joined the Speeti, or great western branch of the Sutluj. On the west were the peaks of the Tuzeegung, or Punjeool, where Gerard effected his ascent of nineteen thousand four hundred and eleven feet, in 1818. Though much earlier in the season, and consequently in the expectation of great difficulties, our party resolved upon undertaking this interesting ascent. The first village in the Speeti is Leo, and around it is some cultivated land and native vegetation—a rarity in this region of rocks and precipices. The male inhabitants wear club tails, and shoes of tan leather, made very like a tub. They do not tan leather north of Pooari: some which our travellers saw had the Russian mark on it. The hills were tilled with yoked sheep. From hence they crossed the Speeti, or Tulukna, on a sango, and effected an ascent of four thousand feet to the village of Nako. The rocks around both Leo and Nako are almost entirely destitute of vegetation, and lie in huge broken masses and “perupt crags,” cast about in disorder, as if by the influence of subterranean force. There are three temples built of red brick in Nako, in one of which our travellers took up their residence and made their preparations. The natives endeavoured to dissuade them by exaggerated accounts of the difficulties, and of the dangers of the “bis” or poisonous wind blowing on the snow.

On the 1st of July, at five o'clock, P.M., they began their ascent, and taking their course up a ravine that led from the village, they turned up the hill to the right, and attained, after an hour's ascent, one of the shoulders of the mountain; and another hour brought them to where their tents were pitched, on a level spot under a stony ridge that crossed the way. The view from this spot was very magnificent; and in the stillness of the air, the waters of the Speeti and the Sutluj, which the ridge divided, could be heard, though about fourteen thousand six hundred feet below their encampment. Stunted grass and furze grew around. They started next morning at six, having waited an hour for the sun, and reached in three-quarters of hour an extensive tableland, the running streams thickly covered with ice. In the ascent beyond, the snow gave way enough to afford a footing, but sometimes so much so as to let them in up to the waist. One of the party, Captain Browne, sunk nearly to his mouth, and being behind was not heard for some time, when he was extricated from his perilous and fearful situation. The snow-bed, after an hour and a half's progress, changed its plane from an angle of about 15° to one of 75° , rendering farther progress in that direction im-

possible. They accordingly veered round to the right, making directly up the mountain, and in the first part of the journey experienced much difficulty from the hardness of the snow. They, however, effected their ascent to the ridge above. When the clouds cleared away, they found themselves on the brink of a precipice, which, though nearly eight thousand feet above the bed of the Sutluj, Captain Johnson thought could not be more than five hundred yards horizontal distance. "It was amusing," our traveller remarks, "to see with what alacrity, when the veil was drawn from before them, each recoiled without saying a word, and placed the ridge between him and the fringe of snow which hung over the precipice like foam on a wave, and from which long icicles hung pendent, as they afterwards ascertained by cautious explorations on hands and knees."

From hence they advanced along the ridge, the snow affording them a good footing; a narrow strip of rock projecting from this ridge like the neck of a bastion, advancing towards the Sutluj, which opposite to it made a detour to the east; and, at the extremity of this isthmus, the peak rose in the shape of a cone of bare granite, the snow being only lodged on a few ledges and breaks in the sides. Our travellers ascended a mound at the entrance of the isthmus, where they were on a level with the base of the peak. The north-east peak of the mountain, elevated by some hundred feet above the latter, was now visible at an horizontal distance of about two miles.

Captain Johnson had afterwards an opportunity of comparing notes with Dr. Gerard, and he felt satisfied that this was the same spot as that on which this gentleman made his barometrical observations; and nineteen thousand four hundred and eleven feet above the level of the sea, the villagers having attempted to impose upon him by pointing out a much lower spot in the place*. Humboldt's station in the Andes was nineteen thousand three hundred and seventy-four: only one man reached this point with our European travellers.* The villagers grasped their wind-pipes in both hands, and lay down in the snow; and the nuzzeer sepyo, who alone reached the highest station, also complained very much. It is remarkable, that our travellers did not suffer any inconvenience excepting an occasional difficulty of drawing breath. Even in their night-camp it was almost impossible to draw a cigar. They suffered, however, severely from blistering of the skin of the face and neck; and one of the party was snow-blind for a few days.

* The same altitude taken geometrically, in 1821, gave nineteen thousand four hundred and forty-two feet. Dr. Gerard has since this explored the pass at the N.E. frontier of Khoowawur at an elevation of twenty thousand feet.

Our party descended from their lofty situation in a direction different to their ascent, and reached the village in three hours and forty minutes from the time they left the top.

The travellers remained at Nako from July 2d to July 15th, the inhabitants of which village were attentive and obliging. They spoke Thibetian, and had high cheek bones and flat noses; and followed the worship of Lama. The cultivation is the same as in the hills, and the women are made to do all the hard work. The only fruits were gooseberries and apricots; from the stone of the latter they make excellent oil.

On the 15th they continued their route northwards;—country desolate and stony. The slaty-grey pheasant of the hills abounded: Captain Johnson says he never saw it at a less altitude than twelve thousand feet, and it retreats higher as the snow melts. On the route to Chango, the rocks were rounded and water-worn, as if they had been long washed by a torrent. The vegetation around consisted of rose, gooseberry-bushes, some whins, and a few stunted cedars. Chango is so surrounded by mountains, that, though built in a recess by the river-side, it was insupportably hot. Tartary oats were growing around. Wood-guests, and a crow with red legs and beak, were met with at the same place.

They crossed the Speeti, to the north of Chango, and proceeded along its banks to Shealkhur, the boundary foot of the Bishur country. It is merely a cluster of houses surrounded by a high stone wall, situate on a bold brow, commanding the passes into Luddakl. There was no garrison. The rock around bore every appearance of having been subjected to the action of fire, either volcanic or the burning of cliffs (anthracituous ampelites, with sulphuret of iron). Our author mentions black ashes, earth burnt to brick, pieces of tile, and stones welded together—the slaty rock being only burnt on the surface.

Our party left Shealkhur early, and after a tedious ascent of about an hour and ten minutes, came into a country characterized by low and rounded hills covered with long coarse grass. From hence they descended into a deep ravine, formed by the Chalodockpo torrent, and then arrived, along a good road, at Changreejing, an out-farm belonging to Chango. The hills around diminished in ruggedness, but the vegetation consisted merely of stunted deodars and a few poplar trees.

On the 19th they walked out in the direction of Shucktul, the first village in the Chinese country. The ravines were clothed with willow coppices, sweet-briar, and currant-bushes. A pyrocantha was seen creeping over immense masses of rock.

They were now, according to the best information they could get, within three or four marches of the pasture country, or high steppes of Luddakl. Beyond the Chemoreel, about eight days' journey

from this, the low hills are separated from the Valley of the Indus, or, as it is called, the Singecho, by a rugged but not lofty range of hills. On the banks of the Indus, and in a fine open valley, is the town of Leh, beyond which the hills rise again; and the knowledge of the guides did not extend beyond a snowy range of mountains which were said to be higher than the Himma-leh, and to which they gave the name of Kailas or Cailas, which signifies "heaven." Captain Johnson does not think, that, in advancing to the west, they would have met with any opposition to the continuation of their journey, and it was with much regret that, in obedience to their orders, the party set out on the 20th on their return, by Chango, over the Changrung mountain.

They again reposed themselves at Nako till the 1st of August, when they proceeded to Leo, and thence to Hango, having provided themselves with mountain ponies.

From Punjee, whither our travellers proceeded by the road they had followed before, they kept along the western bank of the river, —passing by Cheeni, a village prettily situated, though dirty in itself, and surrounded by the usual fruit-trees—to Rhogee, which is the limit to which the periodical rains extend; and beyond which vineyards disappear. Their journey here was effected by alternate ascents and descents in flights of stairs cut in the solid rock, except in one case where they traversed a pine wood. On the road to Meru, the path winds along a precipice about four thousand feet above the bed of the Sutluj, from which, if a perpendicular were erected, it would pass within one hundred and fifty feet of the path, which in many places was scarcely a foot in width; in this respect, very different from the twelve-feet road described by Sir Robert Porter, with so much horror, in the passage of the Goodjara in the Caucasus. Nothing but the greatest confidence and coolness could have brought our travellers in safety over such passes, which were very frequent in the mountains, but more particularly along the banks of the Sutluj.

In descending from Meru, they got into the long grass jungle again, crossed the Oola Gadh on a sango (in accomplishing which one of the sheep fell over and was lost in the stream), to the village of Oornee.—Jungle, composed of grass and nettles, rising higher than the head. The road continued through woods of evergreen-oak to Chegong, where they got fowls and honey. They started hence in the rain to the bank of the Sutluj, which is here very rocky, and the current rapid; proceeding along its bed, interrupted by a very high rock which they were forced to climb, to the bed of the Bobbeh Gadh, estimated by our travellers to have a fall of a thousand feet in the single mile of its course that was visible. Beyond this they arrived at the made road, or artificial causeway, which was a great relief. The rocks which they had

latterly been travelling amongst were slaty and of a soft texture. They now crossed the Sutluj on a fine broad sango, from which they ascended to the village of Nachan. From Nachan they travelled through deep brushwood, eight or nine feet high, by the little village of Soongra, which has a small Chinese temple of carved wood in it; crossed the Boorhee Gadh, making three fine falls within sight, and ascended towards Tranda. On the ascent, Captain Johnson nearly lost his pony, his hind legs having gone over the precipice. In a deodar wood by the road-side, they saw great abundance and variety of monkeys.

The road descended from Tranda, and then again made alternate ascents and descents to Tuarra, which they passed through, and descended, seven thousand two hundred and forty-eight feet, to Seram, where they encamped near the rajah's palace, which our traveller compares to an English barn adorned with gilt ornaments. The shawl goats, which they had brought with them from the mountains, were suffering much from the heat, and many were already dead. On leaving Seram, our travellers found the bridge swept away from over a torrent towards which they proceeded, and by the side of which, amid heat and vapour, they had to stay nearly five hours while a temporary sango was made. After the ascent on the other side, they had a delightful walk, through woods of various and beautiful trees, to Goura Koti, where they took up their quarters in the verandah of a tomb. Country around cultivated, or covered with pine forests.

The next day they arrived at Rampore, the capital of Bishur, built on the bank of the Sutluj, in a cavity of glittering rock, which renders it one of the hottest places in the north of India. The houses are built in squares, each house inclosing a courtyard, with verandahs and galleries round it. They are roofed with large blue slates, very thick, and laid loosely upon the rafters.

On the 14th, they marched to Dutnugger, the road chiefly level, and the hills rounded and low; from whence, in proceeding to Kotghur, they took by mistake the road by Cohmarsein, a village on a ridge between two valleys which came down from the Naig Kunda Pass, and constitute the dominions of a petty rana, who is much esteemed among the hill-chiefs. Our travellers were invited by the chieftain's son, in English, to stay at his father's house, but they preferred going on to Kotghur, which they reached after a tiresome and long day's journey. Here they were received at the house of Captain Gerard, which was beautifully situated on the side of a cultivated mountain, clothed in the upper part with pine forests. It was about seven thousand eight hundred feet above the sea, and four thousand above the bed of the Sutluj; thermometer never rising above 65°, and the snow only lying

during a month or six weeks, at a depth of three or four feet. Bears were numerous in the woods, leopards were often seen, and hyenas were very common and peculiarly daring. Captain Gerard had two gardens, one on the banks of the river and the other at his house ; in the one he cultivated European vegetables, and in the other the plants of India.

Having rested for a few days at Kotghur, our party started, through wild pine woods, to the Naikgunda Pass ; on the top of which was a bungalow for the accommodation of travellers. The pass is elevated nine thousand and sixteen feet above the sea. They were delayed some time at Naikgunda by the perverseness of the coolies or porters. Our traveller complains bitterly of the difficulties which they met with, and the bribery and corruption that is practised, in the territory of the Company, and which is not met with on the hills. On this subject he remarks, with much justice, that the stupendous journey of Dr. Gerard and the labours of Moorcroft sufficiently attest that our ignorance of the remainder of this most interesting country must be entirely attributed to a want of exertion on the part of the authorities, and to the little encouragement that is held out by them to undertakings of an exploratory character.

They now proceeded to the bungalow of Muttiana, which stands high on a bare point above the village of the same name, where they found the quills of porcupines. Thence they proceeded along the crest of the ridge, from which they had a fine view of the mountains behind them. Viewed at a distance, says our traveller, sufficient to obtain a comprehensive sight, the chain appears to maintain a nearly equal height in the great masses, but about every tenth peak shoots up, mostly in a sharp or angular form, terminating in an *aiguille*, which would be inaccessible even if its base rested on the plains. Many of these peaks lean over to the north-west, as if moved from the perpendicular by a force acting in the same direction, forming an angle of little more than 45° with the horizon.

Passing by Phago and the mountain of Choor (twelve thousand six hundred feet) in Sirmoor, they reached Semlah, where there are some good houses on the Jacko Ridge, which are pleasantly situated in woods of rhododendrons, and are recommended by our travellers for summer residences ; though thunder-storms, of great violence, are said to be frequent. Hence they marched to Lairee, from which they had their first view of the plains over Sabathoo. Passed the fort and village of Hurreepore, to arrive at the latter town, which is surrounded by sandy and desolate hills, and is a station for a Ghoorkha battalion. The village is much infested by snakes and centipedes ; the most common of the former is the

spectacle snake, or cobra di capello, the lethargic effect of whose bite is so well known. Eagles, not to be compared in size to the gurrut, are very common; and vultures and white kites abound, as on the plains.

On the 1st of October, our travellers made their last march on these hills, the country gradually becoming less wild as they approached the spot where the mountains were lost in the plains of the low country. On the same evening they left these fine lofty regions with heavy hearts; and entering their palkees, which they found at Babor, they commenced their journey through the alternating sands and jungle of the north of India.

REMARKS.

Descriptive Geography.—The great chain of the Himma-leh mountains extends in a direction from N. W. to S. E. for about 2000 British miles. Its continuation to the west, called in modern times the Hindoo Coosh, or Indian Mountain (by De Humboldt considered as the prolongation of the Kuen-lun), was the Emodus of the Macedonians and the Imaus of Pliny, and was in those days, perhaps, also called Himma-leh, as the Greek title was borrowed from the Sanscrit.

The culminating points of the chain of the Himma-leh are known to attain an elevation exceeding 28,000 feet. The lowest of the passes, the Tungrung, is 13,739, and the loftiest, to the N. E. of Khoonawur, is 20,000 feet, which would give a relation of the mean height of minimum of crest to the culminating point of 1 : 1.64. De Humboldt found it some years back as 1 : 1.8.

The Himma-leh, in its prolongation eastward, is, according to Colonel Kirkpatrick, called Humla to the north of Yumila, and beyond the Arun, according to Hamilton's map attached to the History of the Gorkha war, the Harpala Mountains. Klaproth and Abel Rémusat have collected from Chinese writings the continuation of the chain in snow-clad peaks to the west of Young-tchan. These turn abruptly to the north-west on the confines of Hou-Kouang, advancing ultimately, —according to De Humboldt, who seeks in descriptive geography for the evidence of the elevation of mountain-chains on longitudinal fissures,—into the sea, at the volcanic island of Formosa.

Geology.—In geology and mineralogy, the observations which Captain Johnson has made assist in corroborating the previous information that had been obtained of the structure of this great Alpine chain, and which appears to present much variety in composition, and phenomena that are in accordance with what has been observed in other places. It would result from the facts recorded by Hodgson, Fraser, Gerard, and our traveller, that granite is more particularly common at the foot of the mountains, and thus, probably, constitutes the base of the chain. It has been asserted, that the predominance of gneiss in the Himma-leh gave to it a secondary constitution; neither has this predominance been established, nor, if it had, does it take away from the primitive and crystalline character of the rocks forming the base

of the chain. From the plains—through the first and second ranges of hills—to the great chain itself, there appears to be a series of bands of supermedial rocks succeeded by sandstones and limestones, and transition rocks (clay-slates and ampelites) reposing alternately on mica slate, gneiss, or granite. In the centre of the chain there are masses of limestone and intermediary rocks locked here and there in upraised crystalline formations (as the sandstones on the northern slope); and these crystalline rocks are found bearing upon their elevated summits and indented ridges rocks of a very modern formation. Thus sandstone has been found at 16,700 feet, ammonites in limestone at 16,500 feet, limestone at upwards of 20,000 feet, and Captain Johnson found clay in the Hungrung pass at 14,000 feet. This elevation of sedimentary rocks, with organic remains or the detritus of former worlds, upon the summits and acclivities of the loftiest mountains in the world, is what is also met with in the high Alps of Europe, both in Switzerland and in the Pyrenees, and the character of these formations, the number of them which have been raised up, and the age of the external beds (in geognostic chronology) indicate the epoch of the elevation of the mountain-chain as compared with others, and has been further observed with regard to the influence which the same relative age had on the direction of the chain as compared to the meridians or parallels of our own spheroid. Captain Burnes has also found the geological character of the Hindoo Coosh to be pretty similar to what we know of the Himma-leh, namely, that the loftiest peaks are composed of granite or gneiss, with associated mica slate, and quartz rock, and intercalated uplifted or outlying conglomerates, sandstones, and limestones, white and sacharoidal in the chain, shelly in the plains.

Zoology.—What Captain Johnson has remarked upon the distribution of the few animals met with during a merely exploratory journey corresponds with the little that is known of the zoology of these almost inaccessible wilds.

The yak, which our traveller often alludes to, is the *Bos peophagus*, *Bos grunniens* of old writers, the grunting ox of Shaw and Pennant. It is domesticated over a vast tract of country from the Altaic mountains to the central part of India, and even a great portion of China. It pastures, according to Turner, on the coldest parts of Thibet upon the short herbage peculiar to the tops of mountains and bleak plains. This animal is of great value to the Tatar tribes. It is an excellent beast of burden, and its milk is abundant, and very productive both of butter and cheese. The horse tails used as standards by the Persians and Turks are made of the hair of their tails, and chowries or fly drivers, employed in India, are formed of the same material. Hamilton calls them changri cattle. The bull is named yak; the cow, dhé.

The ghurl or wild goat (*Capra ægagrus*) is considered by most naturalists as the parent of the domestic varieties of the goat tribe. In this case, which is yet doubtful, the Cashmere goat, the Thibet goat (*Capra Jemlahica*, Ham. Smith), and Blainville's *Capra cossus*, and

the Nepaul goat would be only varieties. Mr. James Wilson, who has specially devoted his attention to the originals of our domestic animals, (*Quart. Journ. of Agriculture*, Edinburgh,) is of opinion that the goat of the Jemlah chain cannot be referred to the *Capra ægagrus* of Pallas.

Among the deer tribe, Captain Johnson uses native appellations, which we have had a difficulty in referring to our natural historical classifications. It may be well to briefly enumerate the recognized species of this tribe inhabiting the chain of the Himmah-leh or its immediate neighbourhood. Among the *Moschineæ*, the musk deer, *Moschus moschiferus*, *xé* of the Chinese. Musk is chiefly obtained from Thibet, probably more from the commercial enterprise of the inhabitants than the predominance of the musk deer in the mountainous regions of that country. Our traveller found the accumulated bones of several species at the foot of a cliff near Jumnotree. Among the *Cervinæ*—the Nepaul stag (*Cervus Wallichii*) of a yellowish brown grey, with a large pale-coloured disk upon the croup. The black deer—also met with in the hills of Nepaul. This is the *Cervus Aristotelis* of Duvaucel, and one species of the *Capreolinæ*, the *Cervus capreolus*, frequenting the crags and ravines of the frontier. Of the antilopes, probably a great number may be found in regions possessing so much variety of climate. A remarkable species, the *chiru*, (*Antilope kemas*, Smith,) which has been looked upon, from having frequently only one horn, as the origin of monocerotes, licornes, or unicorns, and the goral of the Himma-leh (*Antilope goral*, Hardwicke, *Lin. Trans.* vol. xiv.) In allusion to the *Tetraceri* of Leach, Wilson asks, “Is the *Antilope quadricornis* distinct from the *Antilope chickara*?” If from the examination made by Blainville of a cranium from India, the anterior horns are straight in the one and curved a little backwards in the other, the hinder ones straight in the former and curved forwards in the latter, there are probably two species, the striated character of the base belonging only to the latter. Hence we should have, as Lesson has adopted, the *Antilope quadricornis* and *Antilope chickara*—the *Tetracerus striaticornis* of Leach.

The nyl-ghau (blue ox)—(*Antilope picta*) is a vicious and remarkable animal, of which several specimens have lately been exhibited in this country, and has hence become familiar.

Of the birds noticed by Captain Johnson, we have only to remark, that the gurrit, which he was inclined to look upon as a condor, was, no doubt, the lammer-geyer (*Gypsetus barbatus*), whose geographical range is so extensive, and of which a specimen, according to Mr. James Wilson, has been transmitted to the Edinburgh Museum from the Himma-leh mountains. The chuccoree, according to Hamilton, is the *Perdix rufa*, or *P. rubra*, Brisson. The cuckoo (*Cuculus canorus*), which our traveller heard in the mountains, was also noticed by Turner in Bhootan (*Embass.* p. 57). The southern acclivities of the mountain range are the abode of two very beautiful birds, the Impeyan pheasant or monaul (*Lophophorus refulgens*), and

the horned pheasant (trapogan), of which Mr. Gould has figured a new species—"Century of Birds, &c." The red-legged crow observed on the Speeti was, no doubt, the *Coracias graculus* (Pyrrho corax, Tem. Fregilus, Cuvier,) and the wood-quests or wood-pigeon the same as our own bird. On this subject it may be remarked, that not even in the vegetable kingdom do the number of analogies presented between the productions of the temperate climates of the mountains of central Asia and the plains and hilly regions of our own latitudes exceed in interest and in importance what is contained in the striking identification of the birds of the Himma-leh with those of western Europe. Flies, resembling the sand-fly and similar to what Captain Johnson's party were incommoded by on the Pabur, are mentioned by Turner as occurring about Murichom, where most of the people were marked by them.

Vegetation.—The teak (*Tectona grandis*), mentioned by Captain Johnson as composing, with the leesoo and some pines, the vegetation of the jungle of the Deyrah Dhoon, belongs to the natural family of the verbenaceæ, is one of the largest Indian trees, and is valuable for its excellent timber. The vegetation of these jungles appears to vary very much in their trees and shrubs as well as in their gramineous plants. In nearly the same latitudes in the Taryani or plain regions of Nepaul, the most common trees are the Palas (*Erythema monosperma*) and the simul (*Bombax heptaphyllum*, Lam.). The lower part of the hilly region of Nepaul, and some of the adjacent plains, are the seat of the saul forests (*Shorea robusta*, Roxburgh).

The mango (*Mangifera Indica*) is a large tree with foliage somewhat resembling a chestnut. It constitutes (Greville, in *Hist. and Descrip. Account of British India*, vol. iii. p. 165) one of the most frequent and pleasing features in Indian landscape. According to Forbes, mango and tamarind trees are usually planted when a village is built.

The jack (*Artocarpus integrifolia*) is a larger tree than its generic associate, the bread-fruit tree (*A. incisa*), the trunk, according to Roxburgh, being from eight to twelve feet in circumference. The fruit is not much esteemed as an article of diet, though the natives of Ceylon eat it freely (Greville, *lib. cit.*), and it is a common food among the Bhootans (Turner, *Emb. to Thibet*).

The growth of trees and plants and of fruit-bearing trees, analogous and even similar to those met with in our own climate, among the mountains of the Himma-leh, has now been established by accurate botanical researches. We find the narrative of Captain Johnson abounding in notices of groves of apricots, walnuts, peaches, cherries, pears, and apples, and the occurrence of currants, gooseberries, barberries, strawberries, raspberries and other fruits.

The trees most abundant at the foot of the hills were oaks, holly, chestnut, hornbeam, laurels, birches; higher up, pines (*Pinus longifolia*, &c.), and deodars (*Pinus deodar*). The forests of rhododendrons (*Rhododendron arboreum*) were particularly beautiful: white varieties, found by Dr. Wallich on Sheopur, in Nepaul, at an elevation of 10,000

feet, were met with by Captain Johnson at the pass of Laptok. Silver fir, hazel, jasmine, and gum cistus are also mentioned in the narrative. Some tracts were covered by a yellow-flowering composite plant like camomile; willow shrubs, observed by our traveller—according to Turner, grew on the banks of the Tchintchia and with the poplar tree (*Ficus Indica*) around the village of Bhootan. Roses were occasionally met with. Saunders (*Phil. Trans.* vol. lxxix.) mentions *Rosa Alpina*, *R. centifolia*, *R. canina*, *R. Indica*, and *R. spinosissima*, as growing among the hills to the east. Dr. Gerard mentions three species of rhododendron, one flourishing at a height of from 6000 to 10,000 feet, bearing a large red flower; the second from 11,000 to 12,000 feet, with a delicate pink blossom; the third species attains to 14,000 feet, but in the guise of a shrub.

The grains used in these hills are barley and wheat, red and yellow bhattoo (*Amaranthus anardhana*), cheenah (*Panicum miliaceum*), and khoda (*Paspalum scrobiculatum*). The ooa (*Hordeum celeste*) and phapur (*Panicum Tartaricum*) flourish at an elevation of upwards of 13,000 feet. It is quite erroneous to say that grapes will not grow on the Hindoostanee side of the range of the Himma-leh (Major Archer's Tour in India); greensward and plots of graminæ begin to make their appearance immediately at the foot of the hills.

Corn is said, at the southern side, not to be cultivated at an elevation exceeding 10,000 feet. Gerard mentions poor and scanty corn at 13,600. There were fields of rye and buckwheat at the temple of Mileum, according to Captain Webb, at an elevation of 11,408 feet. The spikenard was found by the same observer at 13,000 feet. Strawberries and currant bushes in blossom, June 21st, 11,650; buttercups and dandelions 12,642; a campanula was gathered in seed by Gerard, at Shetool pass, at an elevation 16,800 feet. Captain Johnson found furze and greensward at 14,600. Hills of 5000 feet were clothed to the top with wood. At Bhootan, turf or peat bog 7898 feet. Pass of Seeti, polyanthus at 11,000 feet. Apple trees above Kanum 8998 feet. The punjeol was cultivated to a height of 13,700 feet; above was greensward and furze to 14,600 feet. Horse chestnut and poplar trees grew at Rhogee at an elevation of 9096 feet. According to Captain Burnes, the whole range of the Hindoo Coosh is entirely destitute of wood—presenting a striking contrast in that respect to the Himma-leh.

Physical Geography.—The dripping-rock of Sansadarrah, described by Captain Johnson, resembles what is presented to us in limestone formations in our own country, and sometimes in sandstone rock, when one of the chief beauties—the pendent stalactites—are absent. The spring of Sansadarrah is perhaps upon a larger scale, and surrounded by more magnificent scenery than any similar springs that have been described. The dripping-rock of Knaresborough is an example of these springs in our own country. There is a small one at Roslin, near Edinburgh, which is instructive in pointing out that vegetation of *Marchantia*, *Jungermannia*, &c., which grows in dif-

ferent degrees of humidity from continued streams to drops, or a mere mist or humid atmosphere. It has often struck us, that artificial grottoes with stalactites might be made in limestone districts, by dividing a rivulet or the branch of a rivulet over misshapen or irregular masses of rock and stones, piled together like a dome-shaped edifice. Much value is attached to the introduction of a *Lobelia*; why might not mineralogy be brought to further the improvement of landscape and ornamental gardening?

Captain Johnson describes the waters of the Jumna as of a deep and almost ink-bue colour. This was at a distance of not much more than thirty miles from its sources; and snow was lying in patches on the hills around. This is of importance, because observations on the colour of waters, where they may be supposed to be in their purest state, where they flow from mountains covered with perpetual snow, and where the earth is destitute of vegetation and of alluvial soil, are much wanted. "Nothing," says De Humboldt, "proves that waters are white;" and in situations such as we allude to, naturalists are most inclined to think that the colour of water is blue or green. A late eminent chemist was inclined to look upon the tints of the sea as owing to the presence of iodine. If rivers contain a colouring principle, it is so little in quantity, that it eludes all chemical research. It has been further remarked, that the tints of reflected light, the colour of which comes to us always from the interior strata of the fluid, and not from the upper stratum, are generally very different from the tints of transmitted light; particularly when this transmission takes place through a great portion of fluid, which would be the case in very pure waters. The variety presented in the coloration of rivers is very great; we have merely ventured to point out the bearing of our traveller's observation to one order of considerations. De Humboldt asks if the *Aguas negras* of South America may not be coloured by a carburet of hydrogen; which will remind the reader of Doctor Macculloch's ingenious comparison of the extractive vegetable matter which becomes soluble, in the transformation of plants into peat, to the torrefaction or roasting of coffee.

A spring is described as containing sulphuretted hydrogen, and depositing sulphur, even in the bottom and deep waters of the well. Humboldt supposed, in an instance of this kind (springs of Bergantine in Cumana), that the atmospheric air in the water was decomposed by the sulphuretted hydrogen, nitrogen being delivered. The researches of Professor Daubeny on the thermal waters of Bath led him to believe that the large proportions of nitrogen evolved in those springs is not derived from the atmospheric air.

The heat which the hydrosulphurous springs of the New World acquire in the interior of the globe were found to diminish in proportion as they passed from primitive to superposed formation. This is in consonance with what is now known of the progressive refrigeration of the earth's crust. Native sulphur has also been found depositing itself in crevices in crystalline primary rocks, the temperature

of which was higher than the mean temperature of the surrounding atmosphere. There is nothing, then, in this abundant evolution of nitrogen that militates against the opinions entertained on its generation by the first-mentioned philosopher.

Thermal springs abound so much in the Himma-leh mountains, that our traveller says that they were of almost daily occurrence. The celebrated springs of Jumnotree depositing oxide of iron, and issuing from caverns of snow, have, according to Hodgson, a temperature of 194° Fahrenheit; which, considering the elevation, 10,849 feet, is nearly the boiling point of water:—they issue from granite. Nor far from the same spot, Captain Johnson mentions the occurrence of a spring that would boil rice. The occurrence of these thermal waters in crystalline rocks is a fact of much geological importance, more especially when we thus find them distributed through mountain chains, which appear to bear upon their elevated acclivities sedimentary formations of little antiquity, and which appear in modern times to be still the focus of subterranean movements, and of derangements in the earth's crust. Captain Hodgson experienced slight movements in the earth at his visit to Gangootri; our traveller notices the destruction of the Fort of Djenné by an earthquake in 1803; and Captain Burnes felt violent shocks at Lahore in February, 1832. How modern may be the elevation of water-worn rocks accurately described by Captain Johnson, as occurring on the acclivities of the mountains between Nako and Chango, on the Speeti, and which appearances extend over a large tract of country? Everything, indeed, would lead us to believe that changes have taken place in the configuration of the soil in the neighbourhood of the Himma-leh at comparatively a late period. The Brahmins assert, to the present day, that Cashmere was but lately covered with water, forming, as it were, a lake. Bernier, a Frenchman, who is said to have travelled in Cashmere in the reign of Aurengzebe, first collected facts in evidence of this tradition (*Description de l'Inde, par Anquetil du Perron*. Berlin, 1787). Professor Ehrenberg has ascertained the existence of the royal Bengal tiger in the steppes of the Kirghese and of the high Irtyche, in the present day; and this fact, De Humboldt has ably pointed out, connects itself with the discovery of the bones of elephants at the mouth of the Lena and at Escholtz Bay, in evidencing a gradual change of temperature and the little antiquity of the last revolutions of the soil in Asia. The researches which these able travellers have lately been carrying on, of the relation between the volcanic phenomena of central Asia and the striking geognostic traditions of the Chinese, with the great lowering of the soil around the Caspian Sea and the epochs of the upraising of the different mountain-chains of Asia, attach themselves to considerations of this kind.

The *cataract* which Captain Johnson observed at the head of the glen near the sources of the Pabur equals in interest any falls with which geographers are acquainted. The Ruikan Foss, the highest cascade known, is composed of three falls, one of which is 800 feet high. Our traveller estimates the two falls of the Pabur at 1500

feet; the Chute de Gavarnie, the loftiest single fall, is 1160 feet. The dispersion of the water before it reaches the ground has already been made known from observations made in Mexico; and a still more curious phenomenon is recorded of the river Malkan, at the foot of Elburus, where no current of water is said to be perceived, but the sheet is separated, and drops in isolated masses.

"The *snow-beds* of the *Himma-leh*," says Captain Johnson, "are the glaciers of European Alps." That is to say, the constitution of the great masses of snow that lie in the glens, at the head of the valleys and the acclivities of mountain-groups, are not accumulations of loose snow, but melted and frozen again, sometimes nearly compact and massive, at other times porous and even cavernous; and where, as Ramond has remarked in the Pyrenees, in a vertical section, the hot summers may be distinguished by the thin and transparent bands, and the mild summers by the porous ice, and these again differ from the ice and snow of winter.

Our traveller further remarks upon the absence of snow from the loftiest and most perpendicular peaks of the *Himma-leh* range. It had been already observed by Von Buch, (*Travels in Norway*, p. 153,) that to produce glaciers it is not enough that mountains enter the region of perpetual snows, they must be preserved there by means of a considerable space, for an insulated high mountain and a small chain of mountains can never collect so much ice in one place as is necessary to drive forth a glacier from the upper regions to warm valleys. The glaciers or snow-beds on the acclivities of mountains resemble icicles that melt at their extremity, but the snow-beds of the heads of valleys impel new masses of ice downwards;—the rate of whose progress, Saussure has remarked, may be measured by the march of the *moraines*.

The limits of congelation in the *Himma-leh* mountains were placed by a writer in the *Quarterly Review* as low as 11,000 feet. This would be very little above the lowest height at which snow falls in the same latitudes, which De Humboldt (*Personal Narr.*, vol. i. p. 129) places in 20° N. lat. at 3020 metres. Captain Webb estimated the line of eternal snows at 13,500 feet: Frazer at from 15,000 to 16,000 feet. Captain Hodgson found the Bagiruttee, on the 31st of May, issuing from a snow bed. About the same time of the year, Captain Hodgson, and on the 12th of May, 1827, Captain Johnson, visited the sources of the Jumna, also issuing from Captain Webb found the Gauri bursting from the snow at an elevation of 11,543 feet; but these were all snow-beds or glaciers pushed on by the inexhaustible stores of the mountains. It was a pretty idea of Hodgson, that the hot springs of Gangoutree and of Jumnotree were there to provide water in winter, by the melting of the snow around. The notion is, however, more amusing than philosophical. According to theory, the height of the snow-line between latitudes 27° and 35° would be 11,400 feet. The facts which oppose themselves most to this deduced elevation are the observations of Webb, Gerard, &c., on

the altitude at which habitable spots and even villages are met with, and on the physical aspect of these elevated regions. Thus the first of these observers found the Sutlej flowing in a plain 14,924 feet above the sea, and surrounded by fine pasture land. The facts which have been noticed in the distribution of vegetable forms, while they also militate against the low descent of constant snows, assist in giving some idea of the diversity of climate which is presented by these mountains. In multiplying observations on this subject, it would be of importance to distinguish between observations made at the head of transverse valleys and those made on the acclivities of mountains, or on highly inclined planes or isolated peaks and ridges, as well as in the plains. These circumstances—the configuration of the soil, like the direction of chains of mountains, and the diaphanous character of the air (Humboldt), which at once increases the radiation of the plains, and the power of transmission of the radiated heat—the conducting power of the rock or soil—the clear exposure or unshadowed aspect of the surface, or the circular arrangement of glens with mural precipices, influence the temperature both of the soil and air of the station, and lead, from their neglect, to erroneous deductions in the inferior limit of the snow-line. Jacquemont had already attributed the inequality in the height of the snow-line on the two sides of the Himma-leh to the serenity of the climate of the plains of Ladauk, and the foggy climate that reigns in the Hindoostan side, De Humboldt, in his extended view of the climate of Asia, (*Frâgmens de Géologie et de Climatologie Asiatiques*, tom. ii.) has participated in these ideas. The character of an *excessive* climate, he thinks, is shown in this peculiarity in the lower limit of the snow-line: that even in the Caucasus it is 250 to 300 toises higher than in the same latitude in the Pyrenees. This accurate physical geographer gives for the limit of snows in the Himma-leh, lat. $30\frac{3}{4}^{\circ}$ 31° , for the southern slope 1950 toises, and the northern slope 2600 toises. “This great elevation of the limit of perpetual snow,” he remarks, “between the chains of the Himma-leh and of the Kuenlun, between the 31° and 36° of latitude, and perhaps towards the north-east, in still more elevated latitudes, is a kind provision of nature. By offering a more extensive field for the development of organic forms for pastoral life and agriculture, this elevation of the zone of snow and this radiating power of the Thibetian plains render inhabitable in Asia, to people of a mystic and sombre physiognomy, of a religious and industrious civilization,—an Alpine zone, that, in the equinoxial regions of America, in a more southerly latitude, would be buried under the snow, or exposed to cold winds which would entail the destruction of all cultivation.”
